



To: Distribution
From: Steve Irick
Date: 18 Jan, 1994
Re: LTP Measurement Scan Conventions

There really hasn't been much confusion in terminology among those of us who work on the Long Trace Profiler (LTP). However, in anticipation of new concepts in LTP design, things will be made easier for all of us if we use the same terms for measurement quantities and processes related to the LTP. In particular, a new design concept coming up is that of grabbing more than one intensity data set from the detector array for each measured point on the surface under test (SUT). This would be used for Takacs' idea of using a dual detector array. It would also be used for Irick's polarization division multiplexing idea (which may not work). Another concept, which Bresloff has been using for some time, is that of storing truncated arrays of intensity data in a file. Both of these concepts require descriptive and unambiguous terminology in order to understand the LTP computer program source code and especially in order to write that code.

A measurement "scan" is the process used by the LTP to gather data about the SUT. A scan contains all of the quantities collected by the LTP about the SUT from the time the carriage starts moving until the carriage stops.

During the measurement scan, a "picture" is taken of the SUT for each designated value of "x". x is the axis along the carriage motion direction, and the carriage is assumed to move in the positive x direction during the measurement scan. In the LTP II version, the motor controller issues an interrupt to the computer at each designated value of x. This causes all of the necessary actions to take place in getting the data for that picture.

A picture contains a variety of data. The first datum is the actual value of x. Then follows an array of "frames". Each frame contains the intensity data as seen by the detector array. But a frame need not contain all of the intensity data from the detector array; it may contain truncated data, so that only the important data is retained.

A "pixel" is one element of the detector array. In the Princeton Instruments, Inc. detector, a pixel is expressed as a 16 bit integer, but only 14 bits are significant. It is assumed that a linear (one dimensional) detector array is used, and may have typically $N = 1024$ or 2048 pixels. Pixels are numbered by integer from 0 to $N-1$. The intensity data that a frame contains is in the form of pixels.

An intensity "pattern" is a contiguous set of pixels making up important data in a frame. This data is important because the pattern is derived from a light beam pair in one "limb" of the LTP optical

system. A limb is a light beam pair path between the polarizing beamsplitter and any of the optical surfaces used for reference or to be measured.

There may be just one or more than one pattern in a frame. No assumptions are made about the number of pixels, or what pixels are in a frame, except that all the pixels in a frame are contiguous. Also, within any one picture, there may be a different number of patterns in one frame than in another frame. (However, each picture in a scan is expected to contain the same number of patterns in the first frame of a picture; the same number of patterns in the second frame of each picture; and so on.) For these reasons, each frame is accompanied by three values. The first is how many patterns are expected to be in that frame. The second is how many pixels are in the frame. The third is the starting pixel number in that frame.

It should be clear that I have done more than just define some terms. I have also suggested a structure for collecting and archiving the data. Suggestions are welcome for clarifying terminology, adding terms (that will make understanding clearer and less ambiguous) and a change in structure that will be more efficient. Rewriting the LTP computer program is already underway, so please don't procrastinate!

--Steve.

There is an error in the memo of 18 Jan, 1994. This memo said that each frame is accompanied by three values. Actually, the number of intensity patterns is not stated in each frame. Only the number of pixels (np) and starting pixel number (sp) are stated at the beginning of each frame. The number of intensity patterns per frame is assumed to be the same for each picture, and is given in line 7 of the header as a sequence of numbers, one number per frame.

--sci.